

## TECHNOLOGY DESCRIPTION

The Thermo NUtech Segmented Gate System (SGS) is a combination of sophisticated conveyor systems, radiation detectors and computer controls that remove contaminated soil from a moving feed supply on a conveyor belt. Contaminated soil is diverted by segmented gates to a conveyor belt that deposits the soil on an appropriate ground cloth or other container system for stockpiling and later removal.

Contamination of soils by radionuclides is often heterogeneous. Excavation typically results in significant volumes of clean soil combined with the contaminated soil. The SGS provides a method of separating the clean soil from the contaminated soil based on a criteria supplied by the client.

Thermo NUtech's SGS removes a minimum amount of below criteria soil with the above criteria soil, significantly reducing the overall amount of material that requires disposal. The system works by conveying radionuclide-contaminated soil on moving conveyor belts under arrays of sensitive radiation detectors. The moving material is assayed and a computer logs radioactivity content. The computer then calculates when the elevated activities will reach the end of the conveyor belt and activates the segmented gates to divert the above criteria soil to a separate conveyor, which deposits the soil on the ground or in a container, where it can be segregated and readied for disposal.

The treatment of contaminated soils using the SGS offers the following advantages:

- the system physically surveys the entire volume of soil to be processed;
- no chemicals or other additives are used; and
- generation of secondary waste is limited to PPE and decontamination rinse water.

The SGS is primarily a gamma detection system. The two sets of detectors allow for the radiation measurement of two gamma energy regions of interest (ROI). Beta detectors have also been installed on another Department of Energy project and were successfully used under the limited requirements of that application. Prior knowledge of the primary radioactive contaminants is required based on accurate analysis of the soil to be processed. Since the SGS currently sorts soil based on a maximum of two ROIs, these ROIs must be accurately set for the actual contaminants. Oversize rocks and cobbles cannot be processed by the SGS without pre-crushing.

## SYSTEM SCHEMATIC AND OPERATION

Figure 1 depicts the process flow diagram for the SGS. During system operation, contaminated soil is excavated with standard heavy equipment and relocated to the feed point of the mobile SGS processing plant. Feed soil is screened by the SGS mobile screen/hammermill plant, and all rocks and debris with a minimum dimension greater than approximately 75 percent of the thickness of the soil layer deposited on the main conveyor belt are removed. The soil that passes through the screen/hammermill plant is stored in the feed surge bin, which is a reservoir for soil deposited on the main conveyor belt. A mechanical screed allows soil to flow out onto the conveyor belt in a thickness appropriate for the radioisotope(s) of interest and the soil characteristics.

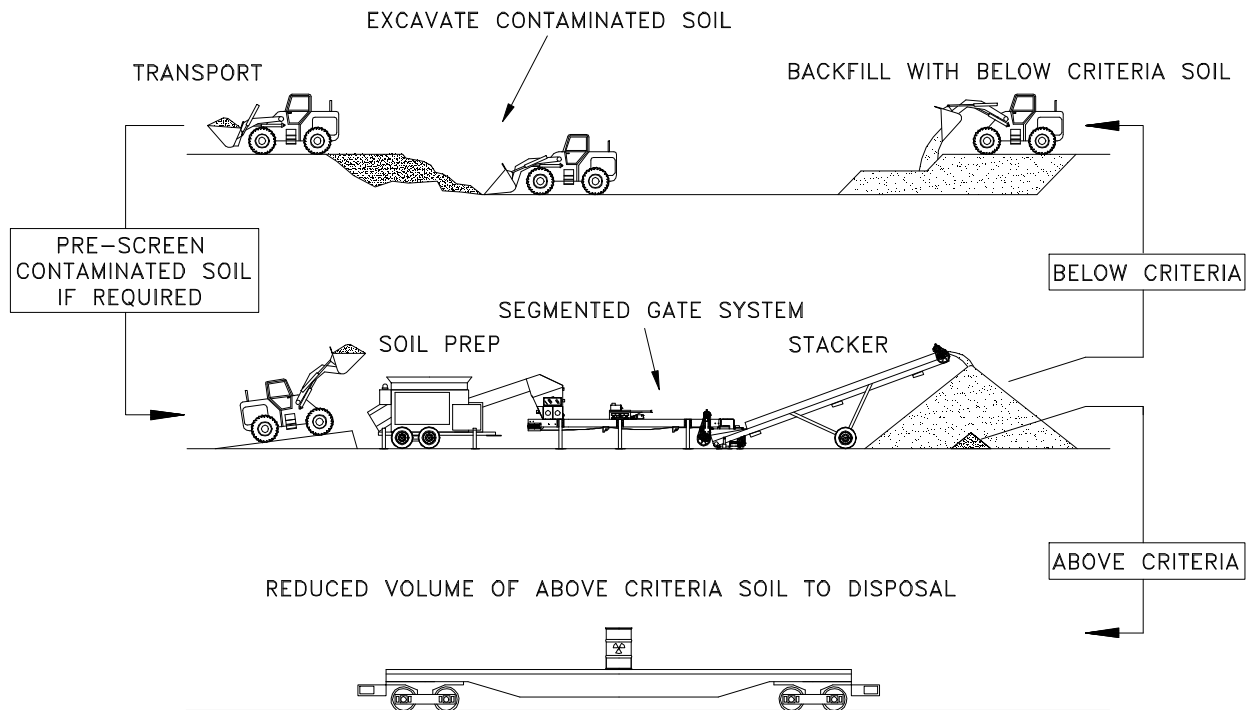


Figure 1. SGS process flow diagram

The soil is then passed under two sets of gamma radiation detector arrays housed in shielded enclosures. The thin detector array is designed for NaI detectors that are 0.160 inch thick, and incorporates a 0.75 inch poured lead shield fully encased by 3/16-inch thick painted steel. The thick detector array uses NaI detectors with a 2.0-inch thick crystal, and is housed in a similar shield with a 1.0-inch thick poured lead shield. Each detector array spans the width of the belt with two rows of detectors, one row containing 8 detectors and the other row containing 7 detectors in an offset arrangement. The two detector arrays operate simultaneously.

The process material is conveyed at a pre-selected speed underneath the detector arrays. Counts from the detectors are collected by an on-board computer, which actuates the pneumatic gates based on the analysis of the activity in the soil by several separate computer algorithms. Contaminated material that exceeds the separation criterion for radioactivity is diverted from the normal soil flow stream and deposited by the above criteria stacking conveyor either in a container or on the ground where it can be packaged for disposal. The below criteria soil is routed to another stacking conveyor and is piled on the ground, where it may be used to backfill the excavation.

## SYSTEM REQUIREMENTS

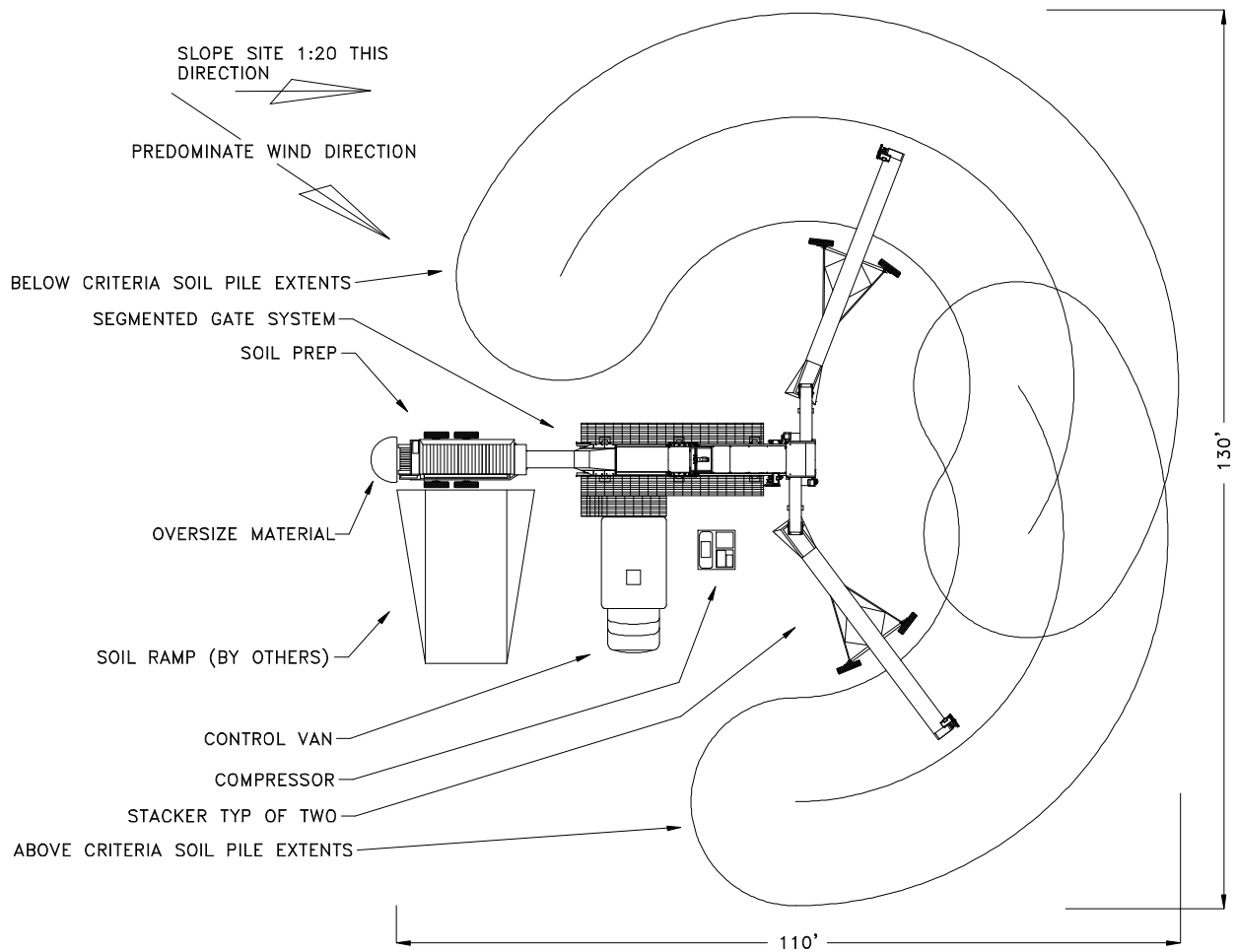
The SGS typically requires a footprint of 110' by 130 feet, as shown in Figure 2.

If the radial stacking conveyors are not needed, this footprint may be reduced significantly. The minimum operating surface is a flat dirt pad, free of debris and vegetation. Compaction of the surface is not normally required unless the soil is unusually soft. The screen/hammermill plant is towed into place. The remaining SGS components are removed from the flatbed trucks used to deliver the system and placed in position using a crane with a minimum capacity of 35 tons.

The SGS is completely electrically operated, requiring 208 volts, 3-phase power at approximately 200 amperes. Power can be supplied from site electrical service if available, or using fuel powered electrical generators. The SGS uses a single phase of the 3-phase power to provide any needed 115-volt single-phase service during operational hours. If generators are used, it is usually desirable to have both a large generator for operating power, and a small 115-volt generator which is used during non-operating hours to supply power for the environmental control unit to maintain a constant temperature environment for the detectors.

A water source is normally required for the decontamination process. Water may also be required for dust suppression, both for the dirt pad and as an addition to the soil to be processed if necessary.

A local or temporary office building is used for project management and record keeping, as well as for breaks and relief of heat stress or other conditions caused by the local climate. Telephone and fax support are not crucial, but significantly add to the convenience of operations, allowing for the transmission of daily reports, client communications, and support from the corporate office for supplies, repairs, etc. Other required amenities are toilet facilities and a potable water supply.



## SEGMENTED GATE SYSTEM FOOTPRINT

**Figure 2**

Soil is usually delivered to the SGS via a front-end loader. The front-end loader is often also used to excavate the site and to move any accumulated soil piles. Front-end loader operations necessitate the availability of fuel and lubrication services, as do the use of any fuel powered electrical generators.

While health physics support is typically provided by the client, Thermo NUtech can provide senior health physics technicians and full radiation safety support. Personal Protective Equipment (PPE) requirements are determined by the entity providing the radiation safety support and PPE can be provided by Thermo NUtech or the client as site conditions dictate.